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Description 2/prts

Method for controlling the distribution of transmission rates in a cellular radiotelecommunication system

In the field of telecommunication close to the terminal, radio links are increasingly gaining in importance. Cordless telephones, mobile radio terminals and the wireless "RLL" (Radio in the Local Loop) or "WLL" (Wireless Local Loop) line interfacing systems are known examples of this. An air interface known as "DECT" (Digital Enhanced (previously European) Cordless Telephone) was defined on the initiative of European companies, with the aim of specifying a standard for a universal high-performance air interface. The DECT standard is described in the documents ETS (European Telecommunication Standard) 300 175-1, ..., 9 October 1992 of the ETSI (European Telecommunication Standards Institute) and is known from these.

A DECT system allows a maximum of 120 simultaneous connections between so-called fixed parts and portable parts - by which, incidentally, is meant not only mobile terminals but, as for example in the case of the wireless line interface system "Radio in the Local Loop", also stationary system components communicating with a fixed part via air interface, which include the functionality of a portable part -, in which system a maximum of 10 frequencies between 1.88 and 1.90 GHz are available and a maximum of 12 simultaneous duplex voice links (time slots, voice channels) can be implemented for each frequency.

The DECT standard also specifies interworking between DECT and "ISDN" (Integrated Services Digital Network). For this reason, time slots with 64 kbit/s transmission rate, intended as support for ISDN, are also specified in addition

to the time slots (channels) with 32 kbit/s ("Full Slots") and 8 kbit/s ("Half Slots") required for voice links.

Fixed parts and corresponding portable parts are generally known which support transmission rates of both 32 kbit/s "Full Slots" and 64 kbit/s "Double Slots" for the faster data transmission of, for example, 64 kbit/s or, respectively, for supporting DECT/ISDN interworking, which thus provide up to six channels with a transmission rate of 64 kbit/s - i.e. a maximum of two complete ISDN connections consisting of two "B channel" basic channels with 64 kbit/s each and one "D channel" control channel with 16 kbit/s.

These fixed parts are integrated into preexisting cordless telecommunication, RLL or WLL systems. Where there is a requirement for high transmission rates, particularly for packet data transmission, this integration is done by substituting fixed parts which support both 32 kbit/s time slots (full slots) and 64 kbit/s time slots (double slots) for the fixed parts which only provide time slots of 32 kbit/s. A problem arising with this procedure is the fact that fully functional fixed parts are removed from existing networks or radiotelecommunication systems even though their procurement costs have not yet been amortized in some cases.

After the substitution, the availability of full-slot connections and double-slot connections is guaranteed, in principle; however, if there is a large number of existing full-slot connections, the case may occur that requested double-slot connections cannot be implemented since, due to the existing full-slot connections, it is not possible to form time slots with 64 kbit/s

transmission rate (double slot). In this case, channels for services having a requirement for high transmission rates, especially the transmission of packet data, can only be provided again when the number of existing full-slot connections has been reduced.

From US 4,748,681, a telecommunication system is known in which a fixed part is in each case operated in a radio cell, the radio cells in each case exhibiting a multiplicity of different portable parts which need different services and the fixed part at least partially supporting these different services and informing the portable parts by means of signaling of the services supported.

The invention is based on the object of specifying a method for controlling the distribution of transmission rates in a cellular radiotelecommunication system in which the radio transmission resources available in the radiotelecommunication system, especially with an RLL or WLL system, respectively, are effectively used.

This object is achieved by the features of patent claim 1.

In the method according to the invention - according to claim 1 - a second fixed part which supports the first transmission rate is in each case additionally installed in the radio cell in a cellular telecommunication system having at least one radio cell with a first fixed part which supports a first low transmission rate and a second transmission rate and at least one portable part for purposes of cordless telecommunication, especially in accordance with the TDMA principle, the second fixed part signaling the support of the first transmission rate in a first

system information item and the first fixed part signaling the support of the second or of the first and second transmission rate depending on traffic.

The essential advantage of the method according to the invention is the possibility of using the second fixed part exclusively for implementing connections having a low transmission rate and the first fixed part predominantly for implementing connections having a high transmission rate so that

adequate supply with time slots of high transmission rate is guaranteed within the radio cell.

In the advantageous further development - according to claim 2 - two lists are maintained in a portable part which supports both the first transmission rate for providing the first service and a second transmission rate for providing the second service. If it is signaled to a portable part in the system information item of a fixed part that the latter supports the first transmission mode, connection-related data, especially the identification of the fixed part, obtained from the system information are stored in a first list. If the fixed part signals to the portable part that it supports the second transmission mode, the connection-related data, especially the identification of the fixed part, are stored in a second list - claim 2.

The advantage of this further development is that the fixed parts are differentiated in accordance with the services provided, in order to guarantee better utilization of the available services.

An essential advantage of the further development in claim 3 (decentralized traffic-dependent control) and claim 4 (centralized traffic-dependent control) is the efficient utilization of the available services since the fixed part which supports services with high transmission rates is kept free of services with low transmission rates by means of suitable signaling.

The essential advantage of the further development in claim 5 is to keep the first fixed part free for telecommunication connections utilizing the second service by exchanging the telecommunication

connection between the first fixed part and the portable part utilizing the first service against an equivalent telecommunication connection to the second fixed part.

The essential advantage of the further development in claim 6 is time stabilization of the method since the hysteresis achieved by means of the threshold values prevents the system information from continuously flipping.

The essential advantage of the further development of claim 7 is the resultant possibility of use in a DECT system.

The essential advantage of the further development of claim 8 is the resultant possibility of use in a GSM system.

The essential advantage of the further development of claim 10 is the simple and inexpensive implementation of the method since the exchange of telecommunication connections is performed without additional measurements and signaling operations.

The essential advantage of the further development of claim 11 is increase in the effective utilization of available services since the first fixed part is rapidly freed for telecommunication connections utilizing the second service with the second transmission rate, due to the rapid exchange of the telecommunication connections.

Further advantageous embodiments of the invention are specified in the remaining subclaims.

An exemplary embodiment of the invention will be explained with reference to figures 1 and 2, in which:

Figure 1 shows two radio cells of a DECT system with in each case one portable part and two fixed parts and a higher-level controller,

Figure 2 shows a flowchart for controlling the traffic-dependent distribution of the transmission rates in fixed parts in the DECT system according to figure 1.

Figure 1 shows a telecommunication system constructed as DECT system, with radio cells PC1 and PC2 constructed as picocells. Information is transmitted in each case via a DECT air interface designed in accordance with the DECT standard, via which the wireless "DECT radio channel" transmission medium is accessed by a combination of FDMA (Frequency Division Multiple Access), TDMA (Time Division Multiple Access) and TDD (Time Division Duplex) access methods. In this system, ten carrier frequencies with a channel spacing of in each case 1.728 MHz (FDMA) are available in the frequency range between 1880 MHz and 1900 MHz, the time frame established per carrier being divided into 24 time slots or channels - also called "slots" (TDMA).

During the transmission of voice data, DECT fixed parts FP11, FP12, FP21, FP22 use time slots with 32 kbit/s transmission rate (full slots), whereas time slots having a transmission rate of 64 kbit/s (double slots) are mainly used for the transmission of packet data by in each case first DECT fixed parts FP11, FP21. A first DECT portable part PP21 uses full slots for transmitting voice data, whereas a second DECT portable part PP11 uses full slots for voice transmission and double slots for the transmission of packet data. The second DECT portable part PP11 stores data records from the DECT fixed parts FP11, FP12, FP21, FP22

which use full slots and the DECT fixed parts FP11, FP21, which use double slots, in the form of separate lists L1, L2 in a memory SP1, SP2. A controller FPC, which is connected to the DECT fixed parts FP11, FP12, FP21, FP22 via a line in order to control them in dependence on the traffic, is superordinate to the radio cells PC1 and PC2.

As an alternative, the connection between DECT fixed parts FP11, FP12, FP21, FP22 and the controller FPC can also be implemented via the DECT air interface.

The DECT system can also be implemented without controller; i.e. the traffic-dependent control is implemented by the fixed parts FP11, FP12, FP21, FP22.

The flowchart shown in figure 2 illustrates the sequence of traffic-dependent control which takes place in the DECT system according to figure 1 between a first DECT fixed part FP11, a second DECT fixed part FP12, the higher-level controller FPC and the DECT portable part PP11 within the picocell PC1 in dependence on a value FS of the traffic load which has been detected by the second DECT fixed part FP12.

In the initial state, the second fixed part FP12 signals to the second portable part PP11 in a second system information item that it supports full slots and the first fixed part FP11 signals to the second DECT portable part PP11 in a first system information item that it supports double slots. Signaling is carried out in each case, for example, by setting and resetting flags.

If the second DECT portable part PP11 finds from the flag set or, respectively, reset in the first system information item that the first DECT fixed part FP11 supports

a transmission mode M2, i.e. use of double slots for transmitting, for example, packet data, the second DECT portable part PP11 stores connection-related data from this system information item, for example, among other things, the identification of the DECT fixed part FP11, in the form of a first list L1. If the second DECT fixed part FP12 signals to the second DECT portable part PP11 in the second system information item that it supports a transmission mode M1, i.e. full slots, for transmitting voice, the second DECT portable part PP11 stores connection-related data from this system information item, for example, among other things, the identification of the DECT fixed part, in the form of a second list L2. The lists L1, L2 are updated by a change in the system information items.

If the number FS of the full slots used by the second DECT fixed part FP12 is greater than or equal to a first threshold value FS_MAX which, together with a second threshold value FS_HY, is determined, e.g. centrally in an information and operation center, or locally in the relevant DECT fixed parts FP11, FP21, the second DECT fixed part FP12 sends a first signaling information item to the controller FPC. The first DECT fixed part FP11 is thereupon controlled by the higher-level controller FPC in such a manner that it signals in the first system information item directed to the second DECT portable part PP11 located in the radio cell PC1 that it supports both full slots and double slots. After having received this system information item, the second DECT portable part PP11 updates its list(s) L1, L2.

If the number FS is smaller than the first threshold value FS_MAX, the second DECT fixed part FP12 checks whether the number FS is less than the second threshold value FS_HY. If this is so, the second DECT fixed part FP12 sends a second signaling information item to the higher-level

controller FPC. The first DECT fixed part FP11 is thereupon controlled by the higher-level controller FPC in such a manner that it signals the support of double slots to the second portable part PP11. After having received this system information item, the second DECT portable part PP11 updates the lists L1, L2 if necessary. In addition, the controller FPC requests the first DECT fixed part FP11 to determine the number of existing full-slot connections (transmission mode M1) between the first DECT fixed part FP11 and the DECT portable parts PP11, PP21 and - if these exist - to report them. If there is at least one full-slot connection, the controller FPC can initiate the handover of a full-slot connection from the first DECT fixed part FP11 to the second DECT fixed part FP12 by means of the second DECT portable part PP11.

If the number is not less than the second threshold value FS_HY or if there is no full-slot connection between the first DECT fixed part FP11 and the second DECT portable part PP11, only the lists L1, L2 of the second DECT portable part are updated, as necessary, and the process recommences with the current number FS.

As an alternative to centralized control by the controller FPC, the traffic-dependent control can also be performed by the DECT fixed parts FP11, FP12, FP21, FP22 as already described with figure 1. In this case the second DECT fixed parts FP12, FP22 in each case determine the current value of the number FS, perform the threshold value comparisons and signal the results to the first DECT fixed parts FP11, FP21 in each case and the first DECT fixed parts FP11, FP21 in each case signal the corresponding transmission modes to the DECT portable parts PP11, PP21 and, if necessary, initiate a handover.

As an alternative to the iterative handover procedure of in each case only one full-slot connection, a number of full-slot connections can be handed over in one step but the number of connections is limited to such an extent that the first threshold value FS_MAX is not reached or exceeded by the handover.